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## PATENT ABSTRACTS OF JAPAN

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(21)Application number : 06-136311

(71)Applicant : FUJITSU GENERAL LTD

(22)Date of filing : 26.05.1994

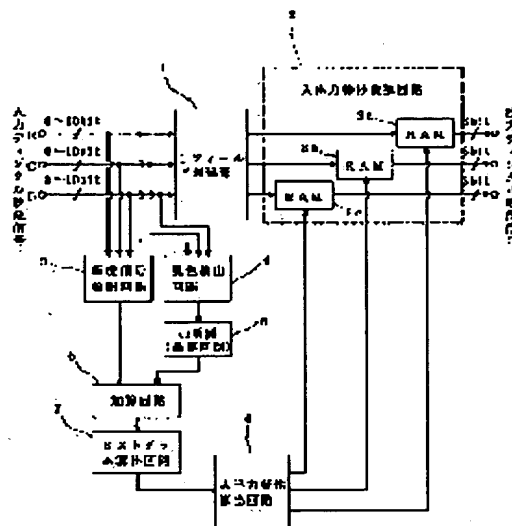
(72)Inventor : SUGAWARA MOTOO

## (54) VIDEO DISPLAY PROCESSING METHOD OF ELECTRONIC DISPLAY AND ITS DEVICE

## (57)Abstract:

**PURPOSE:** To improve the contrast of a screen and to improve the image quality of a skin color part when video is displayed on electronic displays such as an LCD and a PDP, etc.

**CONSTITUTION:** When an input/output characteristic conversion is performed for an input video signal to display the video by the input video signal on an electronic display, the luminance signal of the input video signal is detected by a luminance detection circuit 3, the skin color part in the video by the input video signal is detected by a skin color detection circuit 4, signals in which the skin color part is weighted by a weighting device 5 and the luminance signal are added by an addition circuit 6, histograms in which the luminance level histograms of the skin color part are weighted and added to the luminance level histograms of a background by the added signal are prepared for every field in a histogram calculation circuit 7, the input/output characteristic is determined according to the average value and the dispersion of the histograms, the data for the input/output characteristic calculation circuit 8, the data is written in the RAM 2a to 2c of an input/output characteristic conversion circuit 2 and the input/output characteristic conversion is performed for the input video signal delayed by a one-field delay part 2 in the RAM 2a to 2c.



## LEGAL STATUS

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(71)出願人： 株式会社富士通ゼネラル

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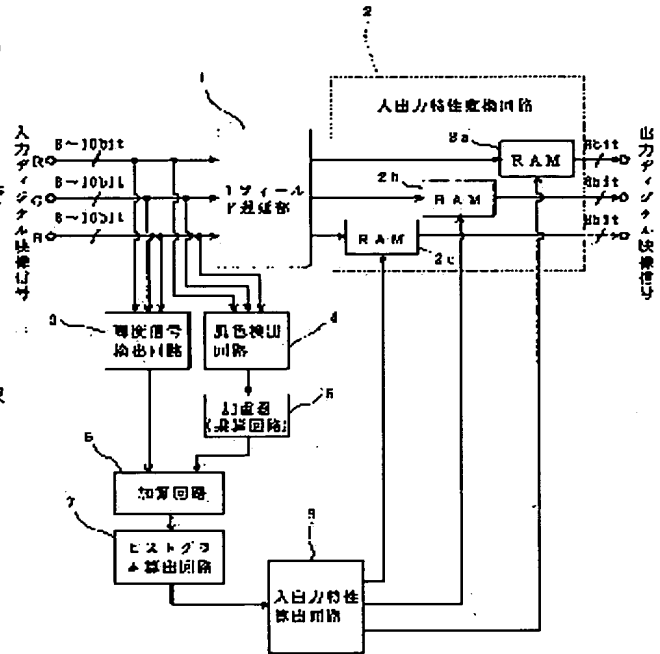
(72)発明者： 菅原 元雄

(54) 電子ディスプレイの映像表示処理方法およびその装置

(57)【要約】(修正有)

【目的】LCDやPDP等の電子ディスプレイに映像を表示する際、画面のコントラストを改善し、肌色部分の画質の向上を図る。

【構成】入力映像信号による映像を電子ディスプレイに表示するために同入力映像信号を入出力特性変換する際、入力映像信号の輝度信号を輝度検出回路3で検出する一方、入力映像信号による映像の中の肌色部分を肌色検出回路4で検出し、肌色部分を加重器5で加重した信号とその輝度信号とを加算回路6で加算し、加算された信号により肌色部分の輝度レベルヒストグラムを背景の輝度レベルヒストグラムに加重和したヒストグラムをヒストグラム算出回路7で1フィールド毎に作成し、ヒストグラムの平均値、分散に応じて入出力特性を決定して入出力特性変換のためのデータを入出力特性算出回路8で得て入出力特性変換回路2のRAM2a～cに書き込み、1フィールド遅延部2で遅延された入力映像信号をRAM2a、2b、2cで入出力特性変換する。



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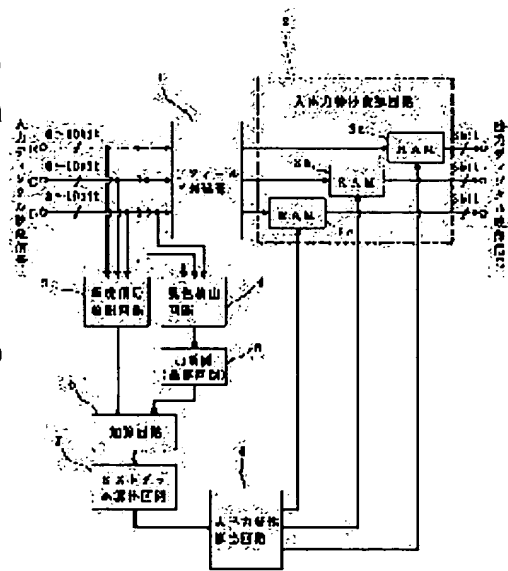
(72)Inventor : SUGAWARA MOTOO

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### (57)Abstract:

**PURPOSE:** To improve the contrast of a screen and to improve the image quality of a skin color part when video is displayed on electronic displays such as an LCD and a PDP, etc.

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## CLAIMS

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[Claim(s)]

[Claim 1] The graphic-display art of the electronic display carried out [ computing the average and distribution with the histogram which weighted the histogram of the intensity level of the whole image, added the histogram to the intensity level of the beige portion of the image by the aforementioned input video signal, and was obtained, and having computed the data for carrying out input-output-behavioral-characteristics conversion of the aforementioned input video signal according to this average and distribution, when carrying out input-output-behavioral-characteristics conversion of the input video signal according to the property of an electronic display, and ] as the feature.

[Claim 2] It is the graphic display art of the electronic display which carries out input-output-behavioral-characteristics conversion of the input video signal according to the property of an electronic display. the aforementioned input video signal -- the 1 field -- or, while one frame is delayed Detect the luminance signal of the aforementioned input video signal, and the beige portion of the aforementioned input video signal is detected. Count the number of pixels for every same signal level of a video signal with the signal added by weighting the luminance signal by which detection was carried out [ aforementioned ] with the signal of the detected this beige portion, and a histogram is created. Compute the average of the created this histogram, and distribution, and input-output-behavioral-characteristics data are computed according to this average and distribution. The graphic display art of the electronic display characterized by carrying out input-output-behavioral-characteristics conversion of the 1 aforementioned field or the video signal delayed one frame using these input-output-behavioral-characteristics data.

[Claim 3] It is the graphic display processor of the electronic display which carries out input-output-behavioral-characteristics conversion of the input video signal according to the property of an electronic display. the aforementioned input video signal The 1 field or a delay means by which one frame is delayed, A luminance-signal detection means to detect the luminance signal of the aforementioned input video signal, and a beige detection means to detect the beige portion of the image by the aforementioned input video signal, An OR means to add the load means which carries out a fixed number of multiplication to the signal of this beige portion, and the signal of the beige portion by which a fixed number of multiplication was carried out [ aforementioned ] to the luminance signal by which detection was carried out [ aforementioned ], A histogram calculation means to compute a histogram by counting the number of pixels for every same signal level of a video signal with the added this signal, An input-output-behavioral-characteristics calculation means to compute the average of the computed this histogram, and distribution, and to compute input-output-behavioral-characteristics data according to this average and distribution, The graphic display art of the electronic display characterized by having the input-output-behavioral-characteristics conversion means which carries out input-output-behavioral-characteristics conversion of the 1 aforementioned field or the video signal delayed one frame using these input-output-behavioral-characteristics data, and which carries out output-characteristics conversion.

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[Translation done.]

## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the graphic display processing technology in the electronic displays (LCD (liquid crystal display panel), PDP (plasma display panel), etc.) used for television etc. at charge, the graphic display art of the electronic display which attains high definition-ization of a display image in detail especially, and its equipment

[0002]

[Description of the Prior Art] When displaying the image by the input video signal on an electronic display (it is described as Following LCD), for example, a liquid crystal display panel, and a plasma display panel (it is described as Following PDP), according to the properties (gamma property etc.) of an electronic display, signal processing of the input video signal is carried out to predetermined.

[0003] If it is in this signal processing, generally input-output-behavioral-characteristics transform processing for a gamma correction is performed, for example to video signals (RGB digital video signal), such as television, and the display of the proper image by this video signal to an electronic display is enabled.

[0004]

[Problem(s) to be Solved by the Invention] By the way, it is difficult for LCD and PDP to run short of the contrast and the brightness of the display image generally among the above-mentioned electronic displays as compared with other electronic displays, and to obtain a good image, for example, the present condition is that whose flesh color which is easy to attach to people's eyes is not so good.

[0005] Moreover, in the above-mentioned electronic display, in order to stop power consumption uniformly in consideration of power consumption, a life, etc., when not bright on the whole (i.e., when dark in the whole screen), the brightness of the peak of a display image will also become [ a display image ] low, the quality of image of a display image will deteriorate, and the beige portion which is easy to attach to especially people's eye will become dark.

[0006] This invention is made in view of the above-mentioned technical problem, and the purpose can aim at improvement in the quality of image of a display image, and flesh color becomes beautiful, and it is in offering the graphic display art of the electronic display with which the fitness of contrast enabled it to obtain an image, and its equipment.

[0007]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the graphic display art of the electronic display of this invention, and its equipment When carrying out input-output-behavioral-characteristics conversion of the input video signal according to the property of an electronic display, The average and distribution are computed with the histogram which weighted the histogram of the intensity level of the whole image, added the histogram to the intensity level of the beige portion of the image by the aforementioned input video signal, and was obtained. Let it be a summary to have computed the data for carrying out input-output-behavioral-characteristics conversion of the aforementioned input video signal according to this average and distribution.

[0008]

[Function] Since it considered as the above-mentioned means, while the luminance signal of an input video signal is detected, the beige portion of the image by this input video signal is detected, and the signal of this beige portion is weighted, it is added to the luminance signal, and the number of pixels counts by the counter for every same signal level of this added signal, and it is totaled by every 1 field (or one frame), and the histogram of an input video signal (the same signal level) is created.

[0009] Thus, the histogram which weighted and added the histogram to the intensity level of a beige portion to the histogram to the intensity level of an image (background) is obtained. While the average (APL; average level) of a histogram and distribution are computed by input-output-behavioral-characteristics calculation means by which this histogram was inputted, input-output-behavioral-characteristics data are computed by it by input-output behavioral characteristics being determined based

on this average and distribution.

[0010] In this case, although the above-mentioned input-output-behavioral-characteristics data are obtained for example, by  $y=1/2 \cdot (x/c)$  (gamma \*\*), this c value is determined according to the average of a histogram, and a gamma value is determined according to distribution of a histogram.

[0011] Thus, since it is determined according to the average of a histogram, and distribution as data for carrying out input-output-behavioral-characteristics conversion of the input video signal, black crushing of a screen is suppressed, and white crushing is suppressed, and an image is obtained for the fitness of contrast.

[0012] And since the histogram of the above-mentioned beige portion is added to the histogram of an image (background) at a load, the histogram to the intensity level of the beige portion becomes large. That is, since the gamma value of the input-output behavioral characteristics in the beige portion is determined as a large value, a beige portion becomes bright and the good display image of contrast is obtained.

[0013]

[Example] The graphic display art of the electronic display of this invention, and its equipment The luminosity of a screen etc. can be judged by the average (APL; average picture level) of the histogram to the intensity level of an image, and its distribution (or standard deviation). That is, it notes that the luminosity of a screen etc. is reflected in the average and distribution. In order to display the image by the input video signal (RGB digital video signal) on an electronic display, when carrying out input-output-behavioral-characteristics conversion of this input video signal, According to APL of a histogram and distribution which added the histogram to the intensity level of the beige portion of the image by the input video signal at the load at the histogram to the intensity level of the whole (background) image, and obtained, the data for the above-mentioned input-output-behavioral-characteristics conversion are determined.

[0014] As shown in drawing 1 , therefore, the graphic display processor of this electronic display 1 field delay section 1 delayed the 1 field in an input video signal (RGB digital video signal), The input-output-behavioral-characteristics conversion circuit 2 which consists of RAM 2a, 2b, and 2c in order to perform input-output-behavioral-characteristics transform processing (gamma correction etc.) to this delayed video signal, The luminance-signal detector 3 which detects the luminance signal of an input video signal, and the beige detector 4 which detects the beige portion of the image by the input video signal, With the adder circuit (OR circuit) 6 adding the load machine 5 (multiplication circuit) for carrying out a fixed number of multiplication to this detected beige portion, and acquiring the signal of a beige portion, and the above-mentioned luminance signal and the signal of a beige portion, and this added signal The histogram calculation circuit 7 which computes the histogram which weighted the histogram to the intensity level of a beige portion, and was added to the histogram to the intensity level of the whole image, It has the input-output-behavioral-characteristics calculation circuit 8 which computes the average of this weighted histogram, i.e., APL, (average picture level), and distribution (or standard deviation), and computes input-output-behavioral-characteristics data based on these APL and distribution.

[0015] If it explains concretely, when the beige detector 4 judges the place which is within the limits with the ratio of R of an input video signal, G, and B signal level to be beige, for example,  $R(\text{red}):G(\text{green}):B(\text{blue}) = (1.3-1.7):(1.1-1.3):1$ , i.e., B, is set to 1, 1.3-1.7G will judge [ R ] that within the limits of 1.1-1.3 is beige. The load machine 5 makes one signal the R judged that is beige, G, and B signal, and they carry out a fixed number of multiplication, and it is outputted.

[0016] An adder circuit 6 carries out the OR of the luminance signal from the brightness detector 1, and the beige signal from the load machine 5, and outputs them. The histogram calculation circuit 7 is a counter, counts the number of pixels for every same signal level with the signal (data) by which the OR was carried out, and computes the histogram which totals for every field and is shown in the dashed line curve of drawing 3 . That is, the histogram to the intensity level of the beige portions (a person's face, a hand, etc.) of not only the histogram to the intensity level of an image (background) but its image is weighted at the intensity-level histogram of the background, and, in addition, the histogram concerned is

created.

[0017] Next, operation of the graphic display processor of the electronic display of the above-mentioned composition is explained in detail with reference to drawing 2 and the property view of drawing 3. In addition, the histogram shown in drawing 2 and the dashed line curve of drawing 3 is a relative value to I/O level.

[0018] First, the image by the input video signal (RGB digital video signal (8 bits or 10 bits)) which carried out predetermined processing of the television signal (NTSC signal), for example shall be displayed on electronic displays (LCD, PDP, etc.).

[0019] At this time, 1 field of 1 field delay sections 2 is delayed, and they output an input video signal to the input-output-behavioral-characteristics conversion circuit 2. On the other hand, the luminance-signal detector 3 inputs the data for 8 bits of an input video signal (8 bit data of high orders), and detects the luminance signal of this input video signal. Moreover, as mentioned above, with the beige detector 4 and the load vessel 5, it detects and outputs by making R and G judged that are beige, and B signal into one signal (for example, 8-bit data) which carried out a fixed number of multiplication.

[0020] The histogram which the luminance signal and the signal (8-bit data) of a beige portion are added in an adder circuit 6, it inputs into the histogram calculation circuit 7, and this histogram calculation circuit 4 computes the histograms A and B to the whole (background) image by the input video signal as shown in the dashed line curve of drawing 3, and the intensity level of a beige portion for every field, that is, weights the intensity-level histogram of a beige portion at the intensity-level histogram of a background, and was added is created.

[0021] In addition, by this invention, although the luminance signal Y detected by the luminance-signal detector 3 is usually the rate of  $Y=0.30R+0.59G+0.11B$  when an input video signal is what is depended on an NTSC signal, even if the luminance signal is  $Y_a=R+G+B$ , the almost same effect is acquired.

[0022] Moreover, input-output-behavioral-characteristics conversion is carried out, and when output signals, i.e., the signal to output, are 8 bit patterns, 6 bits or 8 bits are enough as the signal level for creating the histogram.

[0023] furthermore -- when displaying the image by the NTSC signal by general 480x680 pixels, even if the pixel block for obtaining the frequency (output level) of the histogram sets a 32x32-pixel block to one, that is, computes APL and a distributed value by making 1 pixel of the pixel block into representation -- the above -- it does not change so much with the case of the histogram which counts the number of pixels and is obtained for every same signal level Therefore, you may make it compute a histogram by taking 1 pixel from 1/16x1/16 or 1 / 32x1 / 32 pixels.

[0024] The input-output-behavioral-characteristics calculation circuit 8 determines the gamma value (0.1-6.0) of input-output behavioral characteristics according to this distribution, and determines the value c from which the output level of the equipment concerned is set to the one half [ greatest ] according to the APL while it computes the distribution and APL, respectively with the histograms A and B (histogram weighted, added and obtained) computed for every above-mentioned field. Furthermore, based on the gamma value and value c which were they-determined, the data for input-output-behavioral-characteristics conversion will be computed by the one following, and it will write in each RAM 2a, 2b, and 2c of the input-output-conversion circuit 2, respectively.

[0025]

[Equation 1]

$$y = \frac{1}{2} \times \left( \frac{x}{c} \right)^{\gamma}$$

In one above, the value and gamma from which the output level of input-output-behavioral-characteristics conversion and x are set to the input level of input-output-behavioral-characteristics conversion, and c is set to  $y=1/2$  by y mean gamma (gamma) value.

[0026] In this case, in the input-output-behavioral-characteristics calculation circuit 8, once memorizing the histogram by which calculation was carried out [ above-mentioned ] to internal RAM, input-output-behavioral-characteristics data are calculated according to the fixed formula which incorporates the data of this RAM for a data-processing means (MPU), and is shown in one above. In addition, what is



necessary is just to use the formula of the ellipse smoothly connected with one above by one above, when exceeding an output level with the value (data) of the place of a high level.

[0027] Thus, the data for input-output-behavioral-characteristics conversion (input-output-behavioral-characteristics data) are computed by creating the intensity-level histogram of an input video signal, and determining input-output behavioral characteristics according to the average of this histogram, and distribution. Since it was made to carry out input-output-behavioral-characteristics conversion (gamma correction) of the input video signal with this data For example, even if it is electronic deep leis, such as PDP with a small dynamic range, black crushing of a display image and white crushing can be suppressed, the contrast of a display image can be improved, as a result a high-definition image can be obtained.

[0028] By the way, although the histogram to the intensity level of the whole image is large as shown in the dashed line A of drawing 2 when a beige portion is dark and a HITOSU gram is created only by the luminance signal of an input video signal, although the whole (background) image is bright in comparison, the histogram to the intensity level of the beige portion becomes small as shown in the dashed line B of drawing 2.

[0029] If the data for input-output-behavioral-characteristics conversion are computed by determining input-output behavioral characteristics based on the average of the histogram shown in the dashed lines A and B of drawing 2, and distribution, it becomes the form shown in the solid line curve of this drawing, that is, gamma (gamma) value of a beige portion will be small, and the beige portions (a face, hand, etc.) which are easy to attach to people's eyes will become darker than the HARASHIN number.

[0030] However, in this invention, since the histogram which weights a histogram to the intensity level of the whole image, and added the histogram to the intensity level of a beige portion has been obtained as mentioned above, the histogram of a beige portion becomes large, as shown in the dashed line B of drawing 3.

[0031] the form shown in the solid line curve of this drawing when the data for an input output conversion are computed by determining input-output behavioral characteristics according to the average of the histogram shown in the dashed lines A and B of drawing 3, and distribution -- becoming -- that is, gamma (gamma) value of a beige portion -- large -- per people's eyes -- being easy -- what has beige portions (a face, hand, etc.) brighter than the HARASHIN number -- becoming -- the beige portion -- beautiful -- becoming -- a result -- a display image -- contrast is reinforced

[0032] Moreover, since the weighted sum of the histogram to the intensity level of this beige portion is carried out to the histogram to the intensity level of the whole image when it is in the place where a beige portion is comparatively bright, the histogram of the beige portion becomes larger, this beige portion becomes beautiful more brightly, and a more desirable result can be obtained.

[0033] Thus, in case input-output-behavioral-characteristics conversion of the input video signal is carried out according to the property of an electronic display, the histogram which weights the intensity-level histogram of an image (background) and added the intensity-level histogram of a beige portion is obtained, and input-output behavioral characteristics are determined according to the average of this histogram, and distribution.

[0034] therefore, the case where the intensity-level histogram of a beige portion becomes large, the gamma value of the beige portion can be enlarged, for example, a beige portion is in a comparatively bright background -- per people's eyes -- being easy -- a beige portion does not become dark, but good graphic display becomes possible, and when a beige portion is comparatively bright, the beige portion becomes brighter and the graphic display of a more desirable result of it becomes possible

[0035] In addition, although the input-output-behavioral-characteristics data of the input-output-behavioral-characteristics conversion circuit 2 are computed for every field of an input video signal and input-output-behavioral-characteristics conversion (a gamma correction is included) of the input video signal is carried out for every field of this in the above-mentioned example, you may make it obtain the data of input-output behavioral characteristics for every frame of an input video signal. In this case, the composition which can be processed for every frame then the same operation as the above-mentioned example, and an effect can be acquired for each circuit.

[0036]

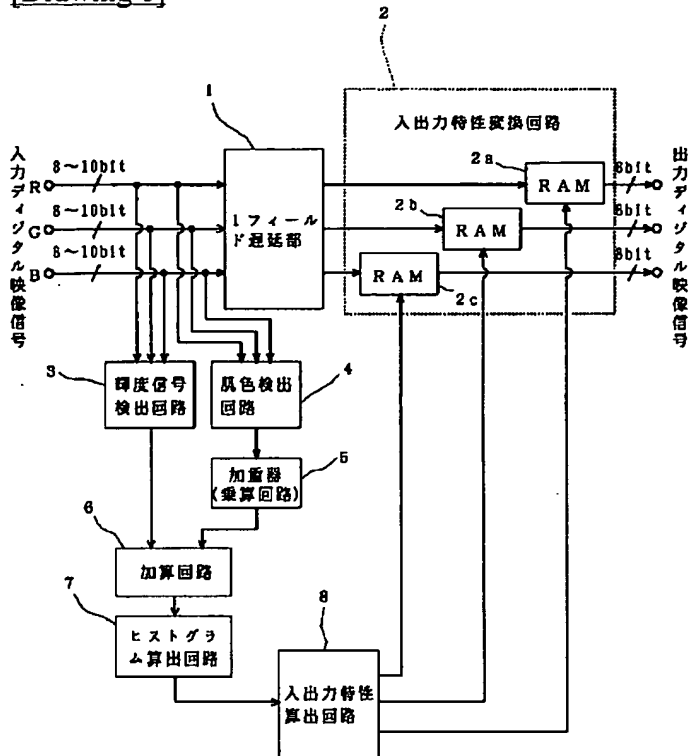
[Effect of the Invention] As explained above, this invention is the graphic display art of the electronic display which carries out input-output-behavioral-characteristics conversion according to the property of an electronic display, and enables the display of an image of an input video signal, and its equipment. In order to display the image by the input video signal on an electronic display, when carrying out input-output-behavioral-characteristics conversion of this input video signal, While detecting the luminance signal of an input video signal, the beige portion in the image (background) by the input video signal is detected. The histogram to an intensity level is computed by weighting the luminance signal and beige portion. The histogram which carried out the weighted sum of the intensity-level histogram of a beige portion to the intensity-level histogram of a background is created. Since input-output behavioral characteristics are determined according to the average of this histogram, and distribution and the data for input-output-behavioral-characteristics conversion were obtained Even if it is PDP with a small dynamic range etc., for example, black crushing of a display image, White crushing can be suppressed and the contrast of a display image can be improved. as a result, the case where a high-definition image can be obtained and a beige portion is in an image (background) -- per people's eyes -- being easy -- the luminosity of a beige portion can be reinforced, that is, the contrast of a screen can be improved, and, moreover, near and the picture of high contrast are extremely acquired by the subject-copy image

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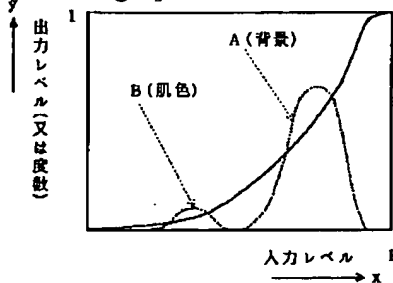
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## DRAWINGS

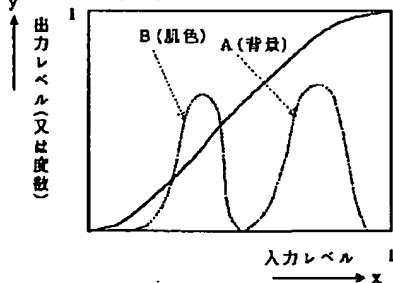
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]